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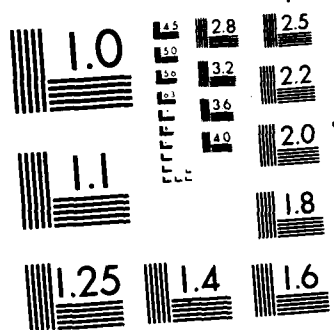
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PHASE II VERIFICATION REPORT
OF
VAMOSC SOURCE DATA SYSTEM
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PHASE II VERIFICATION REPORT
OF
VAMOSC SOURCE DATA SYSTEM
D042A

Contract No. F33600-85-C-7000

30 July 1986

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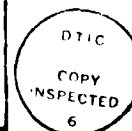
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This report presents an analysis and results of the verification of data provided by the "Comprehensive Engine Management System" (D042A). Analysis includes verification of monthly inputs to D042A and checking accuracy of D042A interface with the "Visibility and Management of Operating and Support Costs" (VAMOSC).	
Comprehensive Engine Management System VAMOSC O&S Cost D042A Verification Report	

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1.0 INTRODUCTION

The Comprehensive Engine Management System (CEMS), D042, is a centralized data base system used by the U.S. Air Force to manage and control the propulsion engine inventory. Categories of engines controlled by D042 include primary engines which propel aircraft and certain air launched cruise missiles and secondary engines which are used in support and ground power equipment. D042A is the transaction based Status and Reporting Subsystem of CEMS which records up-to-date engine ownership, location, and movement. D042A is the major source of data on engine generations, also referred to as Not Repairable This Station ("NRTS"), from bases to organic and commercial depots for rework. It is also a major data source for the Visibility and Management of Operating and Support Costs (VAMOSC) system. D042A was formerly designated D024A until October 1983.

Task 5 of the Statement of Work to Contract No. F33600-85-C-7000 requires Information Spectrum, Inc., to conduct an analysis of the D042A data system and define data elements provided to the VAMOH subsystem (preprocessor) of VAMOSC. ISI is also required to review D042A processing procedures, system logic, and input procedures to establish data validity, accuracy, and completeness. As a result of the analysis and a review of actual data provided to VAMOH/VAMOSC, a statement of D042A shortcomings and concomitant corrective modifications is required. Additionally, the statement of work requires recommended corrective modifications for any VAMOH/VAMOSC

deficiencies uncovered during the review and analysis. This report presents the results of the D042A analysis and review and presents various recommended programmatic and procedural changes to the D042A/D160 subsystems.

1.1 Background

D042A is the Status and Reporting Subsystem of D042, (CEMS) which consists of seven subsystems, D042A through F. Only the D042A subsystem provides input to VAMOH/VAMOSC. D042 collects and reports all world-wide engine transactions through a Central Data Base (CDB) located at the Oklahoma City Air Logistics Center (ALC). Air Force Manual 400-1 Vol II and Technical Manual T.O. 00-25-254 are the policies/procedures and users manuals, respectively, for D042. D042A provides to D160 (VAMOH) the number of engines which have been shipped to a commercial or organic depot for overhaul by either a base or another ALC. Data is provided by engine TMS (Type/Model/Series), MDS (Mission/Design/Series), engine serial number, and base/ALC (SRAN).

The VAMOSC Component Support Cost System (CSCS) uses D042A engine "NRTS" data to develop engine repair costs identified to MDS and base. These are characterized as "Base" costs in VAMOSC. In some instances, engine repair costs are ascribed to an ALC when that ALC removes and ships an engine to another ALC for rework. These are characterized as "Depot" costs in VAMOSC. With base and depot costs provided by H036B, VAMOSC computes Base Exchangeable Repair Costs (Engine), Base Exchangeable

Modification Costs (Engine), Depot Exchangeable Repair Costs (Engine), and Depot Exchangeable Modification Costs (Engine). Second Destination Transportation Costs (Engine) are also computed with a combination of D042A data, engine weight data, and shipping rates for CONUS and overseas shipments. The current computational methodology is predicated upon receipt of engines from bases or other ALC (considered separately in the same manner as components) and subsequent induction into the ALC for rework.

1.2 Verification Methodology

A preliminary review of D042A data input to D160 revealed that a detailed analysis of data received by D160 was not feasible because very little data were being accepted by D160. As shown in Figure 1.2-1, D042A passed a monthly average of 655 records for 14 months in 1983/1984 and a monthly average of 1285 records for 11 months in 1985 to VAMOH. From these records, VAMOH selected an average of 51 and 16 per month each respective year for VAMOSC processing. The lack of engine data was further substantiated through a review of a VAMOSC output report which showed almost no engine costs. Accordingly, it was determined that the standard verification method of checking data flow at selected check points would not yield meaningful results. Therefore, analysis effort was applied to examination of current data processing and selection procedures utilized by D042A and D160 to provide engine "NRTS" counts to D160B. Results of this effort were then compared to available system documentation and policy.

One of the first documents scrutinized was the operative Memorandum of Agreement (MOA), D042A/BDN/D160.-A of 4 November 1983, which specifies the particular records from D042A passed to D160. The MOA selection procedure was then used to determine the records that were transmitted to D160 during the third quarter, Fiscal Year 1985 (FY85). The MOA was also compared with the D160 system specification. The system specification was examined to determine whether the selection criteria conformed to the algorithmic logic prescribed by VAMOSC (AFR 400-31) for costing of engine rework. The content of each record transmitted during the third quarter FY-85 was reviewed and record layout formats in the MOA and system specification were compared. CEMS source document formats, e.g. AF1534, were reviewed to ascertain the availability of certain data elements of importance to VAMOSC selection and processing.

It should be noted that prior to beginning the verification and validation, discussions were held with ALC and AFLC personnel to review D042 system design and operation, availability of data for review, and methodology to be used. During this phase of the review, it was discovered that significant amounts of engine "NRTS" data were not available from VAMOSC reports for analysis. Therefore, other methods and techniques were selected to verify and validate D042A.

2.0 D042A RECORD/DATA VERIFICATION PROCEDURES

2.1 Information Flow

The origination of D042A engine data from ALCs/AFBs to the D042A Accountable Office at OC-ALC is depicted in Figure 2.1-1. A variety of transmission techniques are used to report engine condition and movement to the CEMS CDB. It was important that an understanding of the purpose and procedures of CEMS be gained to determine if any problems in the CEMS data flow induced similar problems in subsequent VAMOSC processing. Since a variety of source documents are used to generate CEMS transactions the data content of these documents has a direct relationship to what can be transmitted to VAMOH (D160) and what is significant to VAMOSC cost reporting.

2.2 Verification Check Points

Four verification check points in the transmission and processing of D042A engine data were chosen to evaluate compliance, appropriateness, accuracy, and completeness. Because it was previously determined that almost no engine costs were being reported by VAMOSC, the verification focused on systems policies, procedures, record format, and MOA compliance. Some minimal data were available which were used to pinpoint system discontinuity. These data were also used in the review. The four check points, depicted graphically in figure 2.2-1 are as follows:

DO 42 A SYSTEM FLOW
 COMPREHENSIVE ENGINE MANAGEMENT SYSTEM
 (CEMS)
 STATUS AND REPORTING SUBSYSTEM

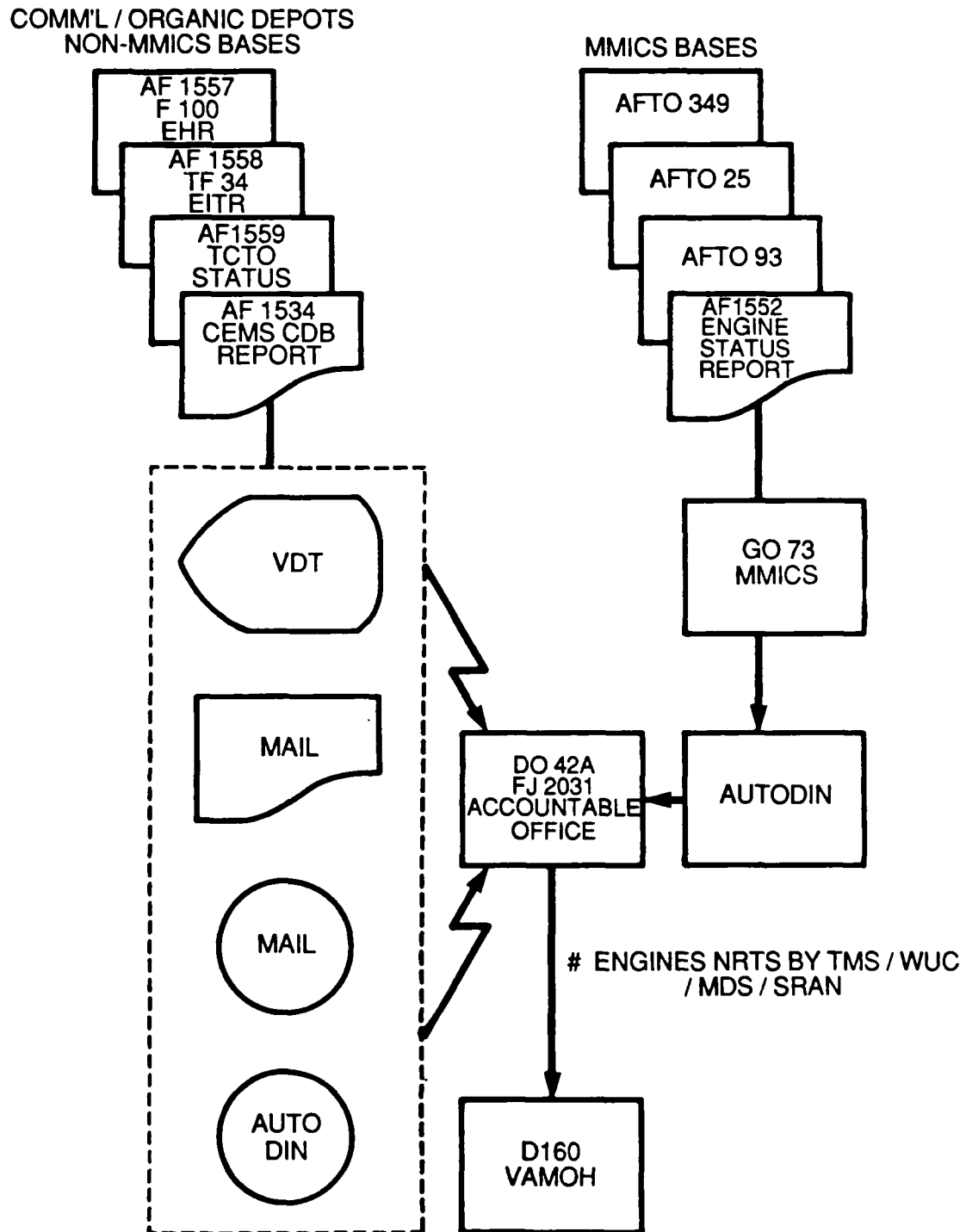
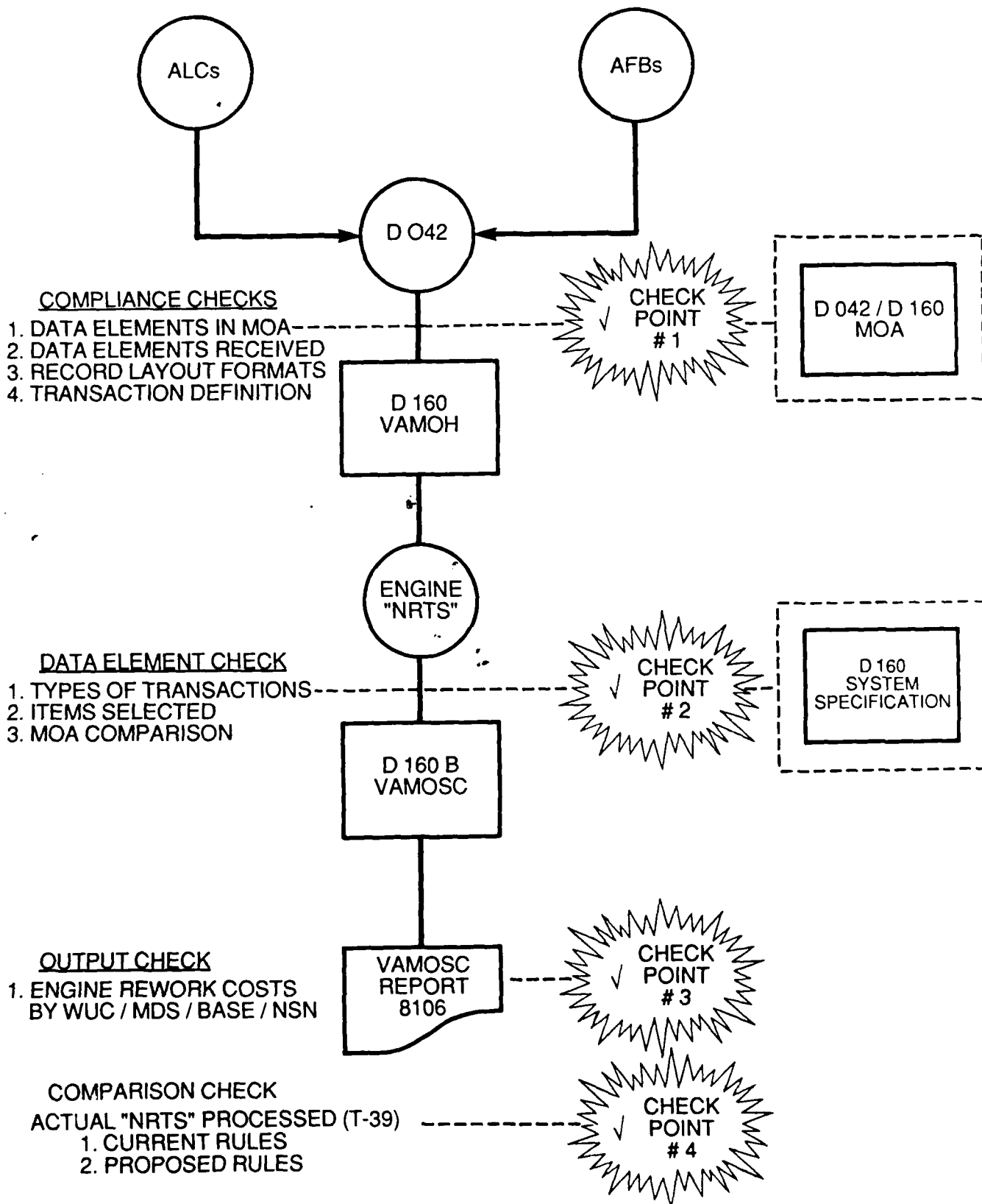


FIGURE 2.1 - 1



VERIFICATION CHECK POINTS
FIGURE 2.2 - 1

Check Point 1 - Actual records received by D160 from D042A showing compliance with MOA including record format comparison, transaction types, and data element correctness (See Attachment C).

Check Point 2 - Actual records received by D160 from D042A showing transactions received, transactions selected, MOA compliance, and appropriateness of selected data to D160B processing.

Check Point 3 - Actual reported engine rework costs reported on a VAMOSC output report.

Check Point 4 - Simulated engine "NRTS" counts using current selection criteria and proposed selection criteria.

2.3 Data Selected For Verification

Source data for this review and analysis were selected from three monthly listings (3rd quarter, FY-85) of all D042A records received for D160 processing. Records on the listings originated from AFBs, ALCs, and contractors. Documentation reviewed and compared included AFR 400-31 Vol IV (CSCS), AFR 400-1 Vol II (CEMS) T.O. 00-25-254 (CEMS Users Manual), MOA D042A/BDN/D160.-A, D160 System Specification (SS) SS-K-11058C, and the D160A SS, SS-K-14010B. A previous VAMOSC output report, RCS HAF-LEY (AR) 8106, CSCS Base Work Unit Code Costs, was screened to determine if engine rework costs were being reported.

2.4 Reviews Conducted at ALCs

During visits to OC-ALC and WR-ALC, an analysis of the current D042A subsystem was conducted with emphasis on data

element definitions as they apply to CEMS outputs to D160 (VAMOH). Actual data stored in the CEMS data bank were observed on a video display terminal at OC-ALC. Definitions of each CEMS record and applicable codes were discussed. System reporting and processing procedural diagrams prepared by ISI were reviewed and confirmed with the responsible OPRs. A review of the D042A/D160 MOA was conducted at OC-ALC and it was confirmed to ISI that CEMS outputs were in compliance with the requirements of that document.

3.0 DATA ANALYSIS

3.1 Check Point 1 - Data Originating from D042A

D042A transaction data for check point 1 were provided by AFLC for the third quarter, FY-85. These data were used to verify D042A/D160 MOA compliance, to ascertain the type of engine data reported, and to check the output record format with the current prescribed record format. The following disparities were noted:

(a) The MOA states that "RL" and "JL" engine Transaction/Condition Code records be transmitted to D160 by D042A ("RL" indicates an engine "Received Requiring Major Overhaul"; "JL" indicates "Work Started Major Overhaul")." Significant numbers of "RL" and "JL" records are being transmitted to D160. However, "PL" records are also being transmitted in quantity. ("PL" indicates "Issue to Maintenance"). For example, in April 1985, VAMOH received 1177 CEMS records of which 522 (44%) were "PL".

(b) Selected records were checked against the record layout, Attachment 1 (A-K0533D-B4A-LM-MLM) to the current MOA of 24 October 1983). (See Attachment D to this report). All data elements on the records checked with the layout. However, a later version of the layout was discovered dated 12 February 1985. This layout contained 10 additional data elements but no additional data positions. The additional data elements at the 05 and 07 levels further defined the makeup of the Transportation Control Number.

(c) Engine transaction data for cruise missile engines and support equipment engines are transmitted to D160. Although the MOA doesn't prevent this, costs for primary engine rework will be overstated unless D160 selection criteria can exclude these engines.

3.2 Check Point 2 - Data Selection By D160 (VAMOH)

Records transmitted by D042A to D160 and the records which were subsequently selected in accordance with the selection criteria listed in the D160 System Specification, SS-K-11058C were tallied for two years and were compared with the requirements of the operative MOA. The following disparities were noted:

(a) Figure 1.2-1 shows that for 14 months in 1983/84, D042A sent an average of 655 records each month to D160. VAMOH selected an average of only 51 records a month during the same period. By contrast, for most of 1985, D042A sent a monthly average of 1285 records (nearly a 100% increase) but D160 selected an average of only 16 records per month (38% decrease from the previous year). It is not clear what caused the disparity between CEMS records transmitted in 1983 and 1984 but it is believed that the change in record selection from "SL" to "RL/JL" accounts for the decrease in records selected.

(b) D160 selects only "RL" records with ALC SRANs. This effectively prevents all base "NRTS" from being counted/costed by VAMOSC. This selection criteria appears to have been established to select engines generated by other ALCs and is entirely

appropriate for that purpose. However, this selection criteria is applied against all D042A records. There is no known specified Base Engine Repair selection criteria. There appears to be no reasons for "JL" records to be transmitted to D160 which is programmed to select only "RL" records. However, the system specification agrees with AFR 400-31, Vol IV (CSCS) which specifies that engine repair cost computations will be based on "RL" transactions categorized as engine "NRTS".

(c) Engines returned to commercial vendors for rework under warranty should not be considered by VAMOSC. A new "Reason For Return To Overhaul" code, "9W", has been established by AFLC in CEMS to identify warranty engines. The D160 selection criteria does not currently address warranty engines.

(d) Cruise missile engines can be selected by D160 unless the MDS table is revised. These engines should not be costed as engine repair costs by VAMOSC.

(e) Some CEMS input records contain "99999" in the WUC field. The input WUC on CEMS records is not significant because the D160B System Specification, SS-K-14010B of 1 June 1983, indicates that VAMOSC uses an MDS table to select the appropriate engine system level WUC (21000, 22000, 23000, 24000, 26000).

3.3 Check Point 3 - Data Processing By D160B (VAMOSC-CSCS)

This check point intended to determine the magnitude of engine repair costs displayed on VAMOSC reports. VAMOSC Report RCS-HAF-LEY (AR) 8106, CSCS Base Work Unit Code Costs, was selected to determine engine rework costs attributable to a WUC,

MDS, and base. All WUCs 21000, 22000, 23000, 24000, and 26000 were checked at 25 AFBs to determine actual "NRTS" count. One "NRTS" count of 2 each was listed for WUC 23Z00 at Elgin AFB. No other "NRTS" counts were found. Thus the costs for even the minimal level of engines being reported are not appearing on VAMOSC output report 8106.

3.4 Check Point 4 - D042 TF-39 Engine Data - Comparative VAMOH Processing Under Current and Recommended Rules.

TF-39 engine data provided by AFLC were used to determine how the data would be processed under current VAMOH/VAMOSC procedures and under the revised procedures recommended herein. The results of the comparison are listed below:

(a) Although data requested from AFLC were to include all Transaction/Condition (T/C) code "LL" and "SL" transactions, no T/C "SL" transactions were provided. However, when T/C "RL" transactions show the previous transaction as T/C "SL", this condition can be considered as a legitimate shipment for this analysis. The data provided were intended to indicate all TF-39 engine transactions for the ten-month period July 1985 through April 1986. The data show all engine removals, any subsequent maintenance change (T/C "ML"), and any subsequent receipt of an engine by a depot level repair facility (T/C "RL").

(b) Analysis of the TF-39 engine data revealed the following (See Table 1):

(1) A typical T/C "RL" transaction includes the Transportation Control Number (TCN) which indicates the shipper

TF-39 ENGINE DATA EXTRACT

<u>ENGINE SERIAL NO.</u>	<u>T/C</u>	<u>DATE PROCESSED</u>	<u>TIME PROCESSED</u>	<u>REPORTING SRAN-BASE</u>	<u>AFB/ALC</u>	<u>PREV TRANS</u>	<u>TYPE REPORT CODE</u>
GE00441070	LF	85185	0400	4410	ALTUS	VA	R
	ML	85196	0950	4497	DOVER	RF	R
	RL	85217	1057	2059	KELLY	SL	R
GE00441168	LL	85204	0500	4427	TRAVIS	VA	R
	RL	85217	1412	2059	KELLY	SL	R
GE00441171	ML	85282	1142	4497	DOVER	RG	R
	RL	85291	0940	2059	KELLY	SL	R
GE00441224	LF	86091	1200	2072	KELLY (BASE)	VA	R
	ML	86093	1400	4427	TRAVIS	RF	R
	RL	86104	1403	2059	KELLY (ALC)	SL	R
GE00441243	LL	85252	0030	4410	ALTUS	VA	R
	RL	85268	1221	2059	KELLY	SL	R
GE00441257	LF	85184	1640	4427	TRAVIS	VA	R
	ML	85191	0842	4427	TRAVIS	JF	R
	RL	85196	1347	2059	KELLY	SL	R
	RL	85213	0818	2059	KELLY	RL	4
GE00441259	LL	85217	0600	4427	TRAVIS	VA	R
	RL	85227	1030	2059	KELLY	SL	R
GE00441284	ML	85360	0915	4427	TRAVIS	GF	R
	RL	86015	1328	2059	KELLY	SL	R
	RL	86015	1328	2059	KELLY	RL	4
GE00441294	LL	85252	0030	4410	ALTUS	VA	R
	RL	85268	1221	2059	KELLY	SL	R
GE00441347	LL	86092	1500	9221	LOCKHEED	SL	R
GE00441353	ML	85242	0005	4497	DOVER	JF	R
	RL	85248	1351	2059	KELLY	SL	R
GE00441404	RL	85227	1520	2059	KELLY	NL	4
GE00441416	LF	85183	1137	4497	DOVER	VA	R
	ML	85183	1345	4497	DOVER	JF	R
	RL	85199	1411	2059	KELLY	SL	R
	RL	85213	0818	2059	KELLY	RL	4

TABLE 1

GE00441444	LF	85199	1059	4427	TRAVIS	VA	R
	ML	85199	1100	4427	TRAVIS	LF	R
	RL	85210	1505	2059	KELLY	SL	R
	RL	85213	0818	2059	KELLY	R4	4
GE00441459	LF	85210	0700	4497	DOVER	VA	R
	ML	85210	0700	4497	DOVER	JF	R
	RL	85217	1412	2059	KELLY	SL	R
GE00441463	LL	85186	0100	4497	DOVER	VA	R
	RL	85196	1347	2059	KELLY	SL	4
GE00441471	ML	85301	0930	4427	TRAVIS	GF	R
	RL	85316	1045	2059	KELLY	SL	R
	RL	85316	1045	2059	KELLY	RL	4
	RL	85316	1100	2059	KELLY	RL	4
GE00441504	RL	85213	0818	2059	KELLY	RL	4
GE00441522	LF	85346	1600	4427	TRAVIS	RA	R
	ML	86027	1243	4427	TRAVIS	JF	R
	RL	86027	0913	2059	KELLY	SL	R
GE00441101	RL	78361	1316	2059	KELLY	RL	4
GE00441134	RL	74206	1316	2059	KELLY	RL	4
GE00441143	RL	85213	0818	2059	KELLY	RL	4

TOTAL SERIAL NUMBERS -132

TOTAL TRANSACTIONS -176

TOTAL NRTS UNDER CURRENT MOA -27

NUMBER NRTS WHEN T/C "RL/4" DISREGARDED -15 (ASSUMES "SL")

TABLE 1

TF-39 ENGINE DATA EXTRACT
MONTHLY VOLUME

	<u>1985</u>						<u>1986</u>			
	<u>J</u>	<u>A</u>	<u>S</u>	<u>O</u>	<u>N</u>	<u>D</u>	<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>
CURRENT MOA	4	12	4	1	2	0	3	0	0	1
RECOMMENDED METHOD	3	4	3	1	1		2	0	0	1

TABLE 1

<u>Year</u>	<u>Month</u>	<u>D024A Inputs</u>	<u>D042A Inputs</u>	<u>Written To CSCS</u>	<u>Not Selected</u>
1983	JUL	1200		194	1006
	AUG	1215		213	1002
	SEP	1125		190	935
	OCT	1035		172	863
	AVG	1144		192	
	NOV		355	8	347
	DEC		666	35	631
	JAN		648	48	600
	FEB		762	47	715
	MAR		746	60	686
1984	APR		846	78	768
	MAY		745	69	676
	JUN		625	57	568
	JUL		617	50	567
	AUG		855	95	760
	SEP		582	63	519
	OCT		676	70	606
	NOV		568	25	543
	DEC		481	10	471
	AVG		655	51	

Figure 1.2-1

<u>Year</u>	<u>Month</u>	<u>D024A Inputs</u>	<u>D042A Inputs</u>	<u>Written To CSCS</u>	<u>Not Selected</u>
1985	JAN		1046	15	1031
	FEB		1041	8	1033
	MAR		1084	12	1072
	APR		1177	10	1167
	MAY		1257	2	1255
	JUN		1498	16	1482
	JUL		1358	15	1343
	AUG		1357	39	1318
	SEP		1455	25	1430
	OCT		1520	15	1505
	NOV		1347	20	1327
	AVG		1285	16	

Explanatory Notes

Two distinct patterns are evident in the above data:

1. When D024A was redesignated D042A in November 1983, record transmission to D160 decreased by 42% a month for the next 14 months. In January 1985, however, record transmission to D160 returned to their pre-1984 level, a 96% increase over 1984 to 1285 per month.

2. When D024A was redesignated D042A, records selected by D160 had been averaging 192 per month. From November 1983 through December 1984 inclusive, D160 selection averaged 51 per month, a 73% decrease. In 1985, record selection continued to slide downward to an average select per month of 16, a 92% decrease over 1983 (D024A) and a 67% decrease over 1984.

AVERAGE MONTHLY RECORDS TRANSMITTED

1983 (4 months) - 1144
1983/1984 (14 months) - 655 (45% Decrease)
1985 (11 months) - 1285 (96% Increase)

Figure 1.2-1

AVERAGE MONTHLY RECORDS SELECTED

1983 (4 months) - 192
1983/1984 (14 months) - 51 (73% Decrease)
1985 (11 months) - 16 (67% Decrease)

Figure 1.2-1

SRAN. Since the typical T/C "RL" transaction also shows the previous transaction as T/C "SL", the base generating the "NRTS" engine can be deduced. This procedure was useful for comparison but is not recommended as the desirable method to be used to count engine "NRTS" in VAMOSC.

(2) T/C "RL" transactions with Type Report Code "4" are record adjustment reports and duplicate, for the most part, previous T/C "RL" transactions. Chapter 10 of AFM 400-1 lists other Type Report codes which will duplicate engine "NRTS" reports to VAMOSC when used in CEMS (e.g., Type Report "C" - Correction).

(3) T/C "ML" transactions which change maintenance on previous T/C "LB" or "LF" transactions are to be considered in the same manner as T/C "LL" transactions (i.e., Removal, Depot Maintenance Required). Under recommended rules elsewhere in this report, T/C "ML" and T/C "SL" transactions shall be matched to produce an engine "NRTS" count for VAMOSC.

(4) A comparison of the T-39 engine data counted under the current MOA specifications and the specifications recommended by this report revealed the following:

D160/D042A MOA

27

ISI Recommended*

15

*Assumes in all but 5 reports that "ML" equals "LL" and previous transaction "SL" in "RL" report is accurate.

4.0 CONCLUSIONS

At the outset of the D042A and D160 interface review and analysis it was learned that engine costing in VAMOSC was suspect but no reasons for this were evident. It has been confirmed through this review that CEMS engine data are not being correctly utilized by VAMOSC because:

(1) proper data representing base and depot engine "NRTS" are not being transmitted by CEMS,

(2) the VAMOH selection process is erroneously selecting depot repair data only, and

(3) the D042A/D160 MOA is not being complied with.

The following explanations are provided:

(a) The "JL", "PL", and "RL" records sent to D160 are of no use in determining engine "NRTS" counts from an AFB. These transactions indicate only that an engine was received at a commercial or organic depot, its maintenance status then changed, and it was then inducted for major overhaul. The AFB identification (SRAN) is not a data element in these records.

(b) The MOA does not require "PL" records to be transmitted.

(c) Because "RL/JL" transactions are related to major overhaul, any engine inducted for minor overhaul is not ultimately costed. However when the average costs for engine rework are obtained from H036B, all costs are obtained, including costs for minor overhauls.

(d) The records transmitted include engines used in cruise missiles and support equipment which should not be included in VAMOSC costing.

(e) The MOA's Generic File Title is "Engine Depot Level Repair Data" and corresponds to the VAMOH System Specification which processes input entitled, "Engine Depot Repair Record" and produces output entitled, "Depot Engines Record". From this it could be concluded that base level engine data was never intended to be used or that a separate base level process is available. Neither is true. The current D160 selection criteria is appropriate for capturing depot "NRTS" as a depot engine generation cost but is inappropriate for base level engine generation costing.

(f) The current D160 System Specification selects engine data records containing "RL" transactions with ALC SRANS only. This procedure effectively excludes base level engine data from being processed by VAMOSC and accounts for the lack of engine "NRTS" data in VAMOSC reports. Even if D042A sent records more indicative of base level "NRTS" shipments, D160 selection procedures processing in their present form would exclude these data from further VAMOSC processing.

(g) Engines shipped to a commercial depot under warranty do not represent a repair cost to the Air Force and should be excluded from VAMOSC. However, some consideration should be given to using these transactions to compute Second Destination Transportation costs.

(h) "Queen Bee" shipments of engines to a depot that were previously received from an AFB should be considered as a base level "NRTS" transaction. This will require the initial base shipment to the "Queen Bee" facility to be suppressed from VAMOSC processing. This is necessary because a "Queen Bee" repair does not qualify as a depot repair cost in VAMOSC.

(i) Transaction/Condition Code "RL" reports containing a Type Report Code other than "R" will result in a duplicate count if transmitted to VAMOH.

(j) Transaction/Condition Code "LF" or and other "L" Transaction Code, when followed by a T/C "ML", for VAMOSC pruposes, can be considered as a T/C "LL" transaction and matched with a subsequent T/C "SL" transaction. In addition, a T/C "ML" transaction in one reporting period which changes a transaction which occurred in a previous reporting period should be accepted as an engine "NRTS" if a matching T/C "SL" occurs.

(k) Although a T/C "RL" contains a TCN which indicates the shipping base SRAN and the previous transaction is shown to be T/C "SL", these transaction do not show the Reason For Return To Overhaul. Therefore, warrenty engines cannot be determined.

(l) The TF-39 data comparison indicates that fewer engines would be counted as "NRTS" by VAMOH if the procedure recommended herein replaced the procedure currently in use. While this appears to contradict the expectation that more engines will be reported as "NRTS" if the current MOA is revised, the fact is that few T/C "RL" transactions are presently being

reported to VAMOH by CEMS under the current MOA. This occurs because the current MOA is not valid for reasons previously mentioned and VAMOSC selection criteria is not correct.

5.0 RECOMMENDATIONS

The Comprehensive Engine Management System (CEMS) should continue to be the source of engine data for VAMOSC computation of engine repair costs. However, several modifications to the D042A/D160 interface and to D160 processing should be made as resources permit. These modifications should be made to correct the significant problems uncovered by this review, primarily to ensure that all applicable engine "NRTS" are reported and that all reported transactions are processed into VAMOSC correctly.

5.1 D042A/D160 Interface

The following changes to reporting and selection criteria, with corresponding rationale, are recommended:

(a) D042A

(1) Transmit Engine Depot Repair Records with T/C "LL" and "SL" vice "JL" and "RL" in positions 83-84 ("LL" indicates removal of an engine from an aircraft; "SL" indicates shipment of an engine). Also transmit any Transaction Code "ML" which modifies an original removal (e.g. "LB") and the matching "SL". This change will more accurately reflect engines which have been removed from aircraft at an AFB or organic depot (from PDM aircraft) and shipped to an organic or commercial depot for rework. This change will also allow minor overhaul engines not selected under current criteria ("JK" transactions) to be counted and subsequently assigned a repair cost. This rationale corresponds to that used in VAMOSC for aircraft components, to wit, "Base Exchangeable Repair Costs". Although T/C "SL"

transactions provide most of the data needed for VAMOH, T/C "LL" and "ML" must also be provided because only these records contain the "Reason For Return To Overhaul" and "Next Higher Assembly" (Aircraft MDS).

(2) Rewrite MOA to reflect the above change.

(b) D160

(1) Revise D160 System Specification (SS) to incorporate the following record selection criteria (Table 2):

<u>Position(s)</u>	<u>Selection Element</u>	<u>Engine Depot Repair Record Description (Attachment D)</u>
2	1	Primary Engine (No change to existing specification)
46-49	SRAN	Base <u>or</u> ALC SRAN
66	"R"	Type Report Code
83	"L", "M" or "S"	Removal, Change in Maintenance, and Shipment, respectively
84	"L"	Major Overhaul
133	"W"	"W" indicates warranty overhaul - available from "LL" and "ML" records only. Do not select.
157-163	MDS	NHA MDS - available from "LL" and "ML" records only.

(2) VAMOH establish matching process for "LL" - "ML" and "SL" records on positions 19-28, Engine Serial Number and 46-49, SRAN.

CURRENT AND RECOMMENDED
VAMOH SELECTION CRITERIA
(RECORD POSITIONS SHOWN IN ATTACHMENT D)

Pos.(s)	Element	Description	VAMOH	
			Recommended	Current
2	"1"	Primary Engine - exclude Support Equipment engines which are reported as "2". Does not exclude turbo-prop engine gear boxes. However, these can be considered as in the same category as F100 engine modules.	X	X
46-49	SRAN	Base or ALC SRAN of activity preparing the report - current selection is by ALC SRANs only.	X	
66	"R"	Type Report. R = Routine	X	
83	"L", "M" or "S"	Removal, Change in Maintenance, and Shipment respectively. Currently, "R" and "J" are selected. The recommended codes more accurately reflect an engine "NRTS".	X	
84	"L"	Requires major overhaul. Although currently selected, its use with "R" and "J" as noted above does not reflect an engine "NRTS" nor does it allow, in these combinations, minor overhauls to be considered by VAMOSC. All base engine shipments are considered major overhaul until a subsequent depot review determines otherwise.	X	X
133	"W"	Reason for Return to Overhaul, in combination with a "9" in position 132, indicates the engine is under warranty. Do not select these records or matching SL records for VAMOSC. This element will only be recorded in the "LL" or "ML" record.	X	
157-163	New MDS	The MDS, or NHA, on which the engine is used and must match an <u>aircraft</u> MDS on the input MDS Table. This check will prevent cruise missile engine records from being forwarded to VAMOSC. Can be checked only in the "LL" or "ML" record.		

TABLE 2

(3) VAMOH continue to create a Engine Depot Repair Record for SRANS which equal 2029, 2030, 2049, 2059, or 2056 (Depot SRAN).

(4) VAMOH create a Base Engine Record for AFB SRANS identified in the Base Code Table (DOC ID = "AVA").

(5) Revise SS-K-11058C page 4-90 to delete any reference to D143F providing input to a VAMOH program that creates the Base Engine Record.

(6) Establish new VAMOSC processing procedures in accordance with paragraph 5.2 below.

5.2 D160 Processing.

In summary, the following administrative, programmatical and processing procedure changes are recommended:

(a) Revise MOA, as follows:

(1) D042A provide Transaction/Condition Code "LL", "ML", and "SL" records for primary engines to D160.

(2) Add new record layout "PIEDLRT" of 85/02/12 to MOA (Attachment D).

(b) Revise VAMOH selection procedure in accordance with paragraph 5.1(b) and Table 1 herein.

(c) VAMOH match "LL" and "ML" with "SL" records by engine serial number (positions 19-28). Matched records will be used to produce either a Base Engine Record (PKHJD) or Depot Engine Record (PKHJE) using Base or ALC SRAN as appropriate in positions 87-90 of "SL" record and New MDS in positions 157-163 of the "LL" or "ML" record. If "9W" appears in positions 132-133 of the "LL"

or "ML" record, it and the matching "SL" record will be non-selected.

(d) Current VAMOSC processing uses base and depot engine "NRTS" counts from D042A received by VAMOH and formats a dummy NSN, formats a system level (two-digit) WUC by matching MDS to engine system using the MDS table, and then adds "1" for each transaction to each unique NSN-BASE-MDS-WUC combination or unique NSN-ALC-MDS-WUC combination, as applicable. This procedure still applies, provided base "NRTS" data are transmitted and properly selected.

(e) For shipments from bases to "Queen Bee" repair facilities, the original "LL" removal transaction or "ML" Change in Maintenance will be selected by VAMOH and will only be matched to a subsequent "SL" shipment by the "Queen Bee" if the receipt of the engine is an ALC or contractor. "LL" or "ML" transactions that match "SL" transactions in position 46-49 containing a "Queen Bee" SRAN in positions 87-90 of the "SL" record will be saved until a subsequent new "SL" transaction from the "Queen Bee" to a depot is matched (Engine Serial No.).

(f) T/C "LL"/"ML" transactions which remain unmatched in the current quarter will be saved until the next quarterly matching process. If these transactions still remain unmatched during the next quarterly matching process, discard. Discard any "SL" transaction over six months old.

The above recommendations presuppose that a new MOA will be negotiated between the D042A and D160 systems. There are two

approaches to implementing the foregoing recommendations. One approach is to require the CEMS data base to extract and transmit only the data required for VAMOSC purposes. This approach allows VAMOSC to edit input data without using a selection routine and requires D042A to selectively extract the required data elements. This approach places a larger programming effort on CEMS than on VAMOSC. The second approach (and the concept currently in use) is for CEMS to transmit standard record formats as requested by D160 and VAMOH select the required data and perform an edit at the same time. This approach places the larger programming effort on VAMOH but tends to place the onus of accuracy on VAMOH and not on D042A. That is, VAMOH would not be dependent on D042A selection programming for complete and accurate data. This latter approach is recommended.

ATTACHMENT A

REFERENCES

1. Air Force Regulation 400-31 Volume I 30 Sep 82; Visibility and Management of Operating and Support Cost Program; Policy and Procedures.
2. Air Force Manual 400-1 Volume II 1 Oct 1983; Comprehensive Engine Management System (D042) Engine Status, Configuration and TCTD Reporting Procedures.
3. D160B System/Subsystem Specification SS-K-14010A; Component Support Cost System (CSCS) of 1 June 1983, pages 4-92 through 4-95.
4. AFLC Memorandum Number: D042A/BDN/D160. A dated 4 November 1983; D042/D160 Interface Memorandum of Agreement.
5. D160 Subsystem Specification, SS-K-11058C, pages 4-90 and 4-91 of 1 June 1985.

ATTACHMENT B

Terms and Abbreviations

AFLC	-	Air Force Logistics Command
ALC	-	Air Logistics Center
BDN	-	Bulk Data Network
CEMS	-	Comprehensive Engine Management System
CSCS	-	Component Support Cost System
JL	-	Transaction/Condition Code for on Work Major Overhaul
MDS	-	Mission, Design, Series
MMICS	-	Maintenance Management Information and Control System
MOA	-	Memorandum of Agreement
NHA	-	Next Higher Assembly
NRTS	-	Not Repairable This Station
NSN	-	National Stock Number
OPR	-	Office of Primary Responsibility
PDM	-	Programmed Depot Maintenance
RL	-	Transaction/Condition Code for Received Requiring Major Overhaul
SRAN	-	Stock Record Account Number
SS	-	System/Subsystem Specification
TCTO	-	Time Compliance Technical Order
TMS	-	Type/Model/Series
VAMOH	-	Visibility and Management Overhaul
VAMOSC	-	Visibility and Management of Operating and Support Costs
WUC	-	Work Unit Code

C-1

DISTRIBUTION DEV-ACTY (SYS-LIB) 1 CY SEQUENCE DEV-ACTY. DSD. RCD-IDY
RECORD LAYOUTS *****REQUESTED*****
AS OF 85/02/12 A-K053D-B4A-LM-MLM 008
PIEDLRT TVI RCD TTL = ENGINE DEPOT REPAIR RECORD - D042A VERSION
OLA 84/02/10

ELEM	LVL	LONG TITLE OF DATA ELEMENT (FIRST 50 CHAR)	LOC-RCD	PICTURE	OCCUR	COBOL DATA NAME	DATA REF NR	STID
001	01	ENGINE DEPOT REPAIR RECORD - D042A VERSION	0001-0001	X(001)	1	PIEDLRT	PK0006	
002	03	CODE, TYPE OF ENGINE	0002-0002	X(001)	1	TYP-ENG-CD-PIEDLRT	PK0007	
003	03	CODE, PRIME OR AUXILIARY	0003-0003	X(001)	1	PRIM-AUX-CD-PIEDLRT	PK0008	
004	03	CODE, AIR LOGISTICS CENTER, SYSTEM MANAGER	0004-0006	X(003)	1	ALC-SYS-MGR-PIEDLRT	PK0008	
005	03	CODE, FAMILY GROUP	0007-0018	X(012)	1	FAM-GRP-PIEDLRT	LV0015	
006	03	DESIGNATION, ENGINE	0007-0009	X(003)	1	TMS12-PIEDLRT	LV0017	
007	05	TYPE, ENGINE	0010-0013	X(004)	1	TYP-ENG-PIEDLRT	LV0017	EN210
008	05	DESIGNATOR, MODEL, ENGINE, POSITION 1	0010-0010	X(001)	1	ENG-MODEL-DESIG-PIEDLRT	MM0122	SE640
009	07	DESIGNATOR, MODEL, ENGINE, POSITION 2	0010-0011	X(001)	1	ENG-MODEL-POS-1-PIEDLRT	MM0122	
010	07	DESIGNATOR, MODEL, ENGINE, POSITION 3	0012-0012	X(001)	1	ENG-MODEL-POS-2-PIEDLRT	MM0135	
011	07	DESIGNATOR, MODEL, ENGINE, POSITION 4	0012-0012	X(001)	1	ENG-MODEL-POS-3-PIEDLRT	MM0137	
012	07	SERIES	0013-0013	X(001)	1	ENG-MODEL-POS-4-PIEDLRT	MM0155	
013	05	FILLER	0014-0014	X(001)	1	SER-PIEDLRT	LV0004	
014	05	NUMBER, SERIAL, ENGINE	0015-0018	X(004)	1	FILLER	008004	
015	03	IDENTIFIER, ENGINE	0019-0028	X(010)	1	ENG-SN-PIEDLRT	410001	
016	03	CODE, WORK UNIT	0029-0030	X(002)	1	ENG-ID-PIEDLRT	410002	
017	03	CODE, WORK UNIT, LINE REPLACEABLE UNIT	0031-0035	X(005)	1	WUC-PIEDLRT	MM0034	MA359
018	05	CODE, WORK UNIT, SUBSYSTEM	0031-0034	X(004)	1	LRU-WUC-PIEDLRT	MM0034	
019	07	CODE, WORK UNIT, SYSTEM	0031-0033	X(003)	1	SUBSYS-WUC-PIEDLRT	MM0088	
020	09	CODE, WORK UNIT, FIRST POSITION	0031-0032	X(002)	1	SYS-WUC-PIEDLRT	MM0087	
021	11	CODE, WORK UNIT, SECOND POSITION	0031-0031	X(001)	1	1ST-POSN-WUC-PIEDLRT	MM0217	
022	11	CODE, WORK UNIT, THIRD POSITION	0032-0032	X(001)	1	2ND-POSN-WUC-PIEDLRT	MM0218	
023	09	CODE, WORK UNIT, FOURTH POSITION	0033-0033	X(001)	1	3RD-POSN-WUC-PIEDLRT	MM0219	
024	07	CODE, WORK UNIT, FIFTH POSITION	0034-0034	X(001)	1	4TH-POSN-WUC-PIEDLRT	MM0220	
025	05	CODE, WORK UNIT, FIFTH POSITION	0035-0035	X(001)	1	5TH-POSN-WUC-PIEDLRT	MM0220	
026	03	CODE, COMMAND OF JURISDICTION	0036-0037	X(002)	1	CMJ-PIEDLRT	410009	
027	03	CODE, MAJOR COMMAND	0038-0039	X(002)	1	MAJCOM-CD-PIEDLRT	440432	SU050
028	03	CODE, SUB COMMAND	0040-0040	X(001)	1	SUB-CMD-CD-PIEDLRT	PK0010	
029	03	CODE, ORGANIZATION	0041-0041	X(001)	1	ORGN-CD-PIEDLRT	410003	
030	03	IDENTIFIER, UNIT	0042-0042	X(001)	1	UNIT-ID-PIEDLRT	410004	
031	03	NUMBER, CARD, SUBSYSTEM	0043-0043	X(001)	1	CRD-NR-PIEDLRT	410005	
032	03	IDENTIFIER, SUBSYSTEM	0044-0044	X(001)	1	SUBSYSTEM-ID-PIEDLRT	MM0354	
033	03	CODE, LOCATION	0045-0045	X(001)	1	LOC-CD-PIEDLRT	PK0038	
034	03	NUMBER, STOCK RECORD ACCOUNT	0046-0049	X(004)	1	SRRN-PIEDLRT	PI0168	
035	03	NAME, STATION	0050-0052	X(015)	1	STA-NM-PIEDLRT	410007	EN273
036	03	CODE, ENGINE, OWNERSHIP ACCOUNT	0053-0065	X(001)	1	OWN-ACC-ENG-CD-PIEDLRT	PK0013	
037	03	CODE, ENGINE, TYPE, REPORT, ENGINE	0066-0088	X(001)	1	ENG-RPT-TYP-PIEDLRT	PK0014	
038	03	DATE, ORDINAL, TRANSACTION	0087-0071	X(005)	1	TRANS-DT-PIEDLRT	LO0008	DA955
039	05	DAY OF YEAR, ORDINAL NOTATION	0087-0089	X(003)	1	DA-PIEDLRT	FI0055	VE010
040	05	YEAR	0070-0071	X(002)	1	YR-PIEDLRT	410240	
041	03	TIME OF TRANSACTION	0072-0075	X(004)	1	TM-TRANS-PIEDLRT	410008	
042	03	NUMBER, CONTROL	0076-0082	X(007)	1	CTL-NR-PIEDLRT	A60016	
043	03	CODE, TRANSACTION	0083-0083	X(001)	1	TC-PIEDLRT	AA0115	MA780
044	03	CODE, CONDITION	0084-0084	X(001)	1	COND-CD-PIEDLRT	AL0122	MA360
045	03	IDENTIFIER, COMMAND	0085-0086	X(002)	1	CMD-ID-PIEDLRT	KK0003	
046	03	CODE, STATION, TO OR FROM	0087-0090	X(004)	1	TO-FR-STAT-CD-PIEDLRT	PK0220	
047	03	TYPE, CONTAINER, ENGINE	0091-0094	X(004)	1	ENG-CNTNR-TYP-PIEDLRT	410011	
048	03	NUMBER, TRANSPORTATION CONTROL	0095-0109	X(015)	1	TCN-PIEDLRT	A40535	TV710
049	05	NUMBER, STOCK RECORD ACCOUNT	0095-0109	X(015)	1	SRRN01-PIEDLRT	A50002	
050	07	CODE, TYPE OF ACCOUNT	0095-0095	X(001)	1	TYP-ACCT-CD-PIEDLRT	8C0094	ID180
051	07	NUMBER, SERIAL	0096-0099	X(004)	1	SN-PIEDLRT	AF0098	
052	07	DATE, TRANSACTION	0100-0103	X(004)	1	TRAN-DT-PIEDLRT	KK0016	DA955
053	07	YEAR, LAST POSITION Y	0100-0100	X(001)	1	LAST-POSN-YR-PIEDLRT	MM0223	
054	07	DAY OF YEAR, ORDINAL NOTATION	0101-0103	X(003)	1	DA01-PIEDLRT	FI0055	
055	05	CODE, TYPE OF SHIPMENT	0104-0104	X(001)	1	TYP-SHPT-CD-PIEDLRT	DE0048	ID180
056	05	NUMBER, SERIAL, SHIPMENT	0105-0107	X(003)	1	SNPT-SN-PIEDLRT	DE0114	
057	05	CODE, SPLIT	0108-0108	X(001)	1	SPLX-CD-PIEDLRT	DE0144	
058	05	CODE, SPLIT SHIPMENT	0109-0109	X(001)	1	SPLT-SHPT-CD-PIEDLRT	DE0037	MI488
059	03	NUMBER, SECURITY ASSISTANCE	0110-0117	X(008)	1	SECY-ASST-NR-PIEDLRT	410012	
060	03	NUMBER, SERIAL, ENGINE, REPAIRABLE	0118-0127	X(010)	1	RPR-ENG-SN-PIEDLRT	410013	
061	03	DESIGNATOR, MALFUNCTION, HOW	0128-0130	X(003)	1	HOW-MAL-DESIG-PIEDLRT	MM0011	HO920

DEV-ACTY LSMMA DSD D160. LD-PGMR CYRUS, GEORGE SYS-LIBR SHEA, BRIAN PH-NR 7872941

DISTRIBUTION DEV-ACTY (SYS-LIB) 1 CV SEQUENCE DEV-ACTY, DSD, RCD-IDV
RECORD LAYOUTS *****REQUESTED*****
AS OF 85/02/12 A-K0530-B4A-LM-MLM 009
MSTR RCD IDV DLA 84/02/10

ELEM LVL	NR	LONG TITLE OF DATA ELEMENT (FIRST 50 CHAR)	LOC-RCD	PICTURE	OCCUR	COBOL DATA NAME	DATA REF NR	STID
062	03	CODE, REASON, OVERHAUL RETURN	0131-0133	X(003)		OVHL-RET-RSN-CD-PIEDLRT	410015	
063	03	NUMBER, OF OVERHAULS	0134-0136	X(003)		NR-OVHL-PIEDLRT	410016	
064	03	NUMBER, OF BASE MAINTENANCE	0137-0140	9(04)		NR-BASE-MAINT-PIEDLRT	410017	
065	03	NUMBER, STOCK RECORD ACCOUNT, LAST OVERHAUL	0141-0144	9(04)		LAST-OVHL-SRAN-PIEDLRT	410018	
066	03	HOURS, ENGINE, SINCE OVERHAUL	0145-0149	9(05)		SINCE-OVHL-ENG-HR-PIEDLRT	PK0024	
067	03	CYCLES, ENGINE LIFE, SINCE NEW	0150-0156	9(07)		NEW-MDS-PIEDLRT	410019	
068	03	SERIES, MISSION DESIGN, NEW	0157-0163	X(007)		ACFT-SN-PIEDLRT	PK0548	
069	03	NUMBER, SERIAL, AIRCRAFT	0164-0173	9(10)		POSN-MR-PIEDLRT	410020	
070	03	TIME, OPERATING, CURRENT	0174-0174	X(001)		CUR-ONTM-PIEDLRT	PK0026	
071	03	COUNT, CYCLE	0175-0179	9(05)		CYC-CNT-PIEDLRT	MN0053	MOB31
072	03	CODE, CONDITION, PREVIOUS TRANSACTION	0180-0184	9(05)		PREV-TRANS-COND-CD-PIEDLRT	410022	
073	03	CODE, OWNERSHIP ACCOUNT, PREVIOUS	0187-0187	A(001)		PREV-OWN-ACCT-CD-PIEDLRT	410023	
074	03	METHOD OF TRANSMISSION	0188-0188	X(001)		METH-TRANS-PIEDLRT	410024	
075	03	DATE, RECEIVED	0189-0193	X(005)		RCV-DT-PIEDLRT	PK0221	
076	03	YEAR	0189-0190	9(02)		VR01-PIEDLRT	PK0358	
077	05	DAY OF YEAR, ORDINAL NOTATION	0191-0193	9(03)		DA02-PIEDLRT	F10240	YE010
078	05	DATE, ORDINAL, PROCESSED	0194-0198	X(005)		DT-PROC-PIEDLRT	F10055	DA955
079	03	YEAR	0194-0195	9(02)		VR02-PIEDLRT	PK0354	
080	05	DAY OF YEAR, ORDINAL NOTATION	0196-0198	9(03)		DA03-PIEDLRT	F10240	YE010
081	05	DATE, POSTING	0198-0198	X(001)		POST-CD-PIEDLRT	F10055	DA955
082	03	CODE, POSTING	0200-0200	X(001)		POST-CD01-PIEDLRT	PK0027	
083	03	CODE, POSTING						

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DEV-ACTY HLMMMA DSD D160. LO-PGMR CYRUS. GEORGE SYS-LIBR SHEA, BRIAN PH-NR 7872941

DATE
FILMED
- 8